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LUMINESCENCE IN THE FUNGI

William A. Murrill

The phenomenon of phosphorescence, or luminescence, in living organisms has long been known and wondered at, but there remains much to be learned about the entire subject. The light-bearing fishes of the deep sea, the "sparkling" waves at the sides of a ship on a dark night, the firefly and glowworm, and luminous bacteria occurring on decaying fish, cabbage, etc., are well known. Molisch's bacteria lamp designed for mines and powder magazines was an attempt to put this process of slow oxidation to some practical use.

In animals, the light is usually brief and intermittent, while certain fungi may give off light continuously for days, weeks, or even months, so long as the light-giving cells are uninjured and active and water is present. This light-giving power is recognized as useful to animals, but is probably without biological significance in plants. One can hardly believe that the spores of *Clitocybe illudens,* for example, are distributed to any great extent by the moths and fireflies that happen to be attracted by the weird light emanating from its spore-bearing surface.

In some fungi, the power of luminescence is confined to the active cells of the mycelium. This is true in the case of *Armillaria mellea,* which inhabits old stumps and often causes them to glow on dark nights. While the rhizomorphs of this species are covered with active hyphae, they are luminous, but when they form a cuticle and enter the resting period the luminosity disappears. The mycelium of the hymenophore of this species is not luminous even when most active.

On the other hand, the sclerotia of *Collybia tuberosa* are said to be luminous; and the writer has observed that the mature hymenophores of *Panus stypticus* may be luminous when the young ones are not. *Xylaria Hypoxylon* is reported luminescent when growing naturally but not in pure cultures, which may possibly be due to the association of photogenic bacteria or other light-producing organisms.

It is impossible to give an accurate and complete list of the more conspicuous luminescent fungi, and some of the names recorded in the literature are very probably synonyms. Among North American species, the following have been reported to have the power to produce light, either in the mycelium or in some part of the fruit-body.

Armillaria mellea (Vahl) Quél.
Ceriomyces crassus Batt.
Clitocybe illudens (Schw.) Sacc.
Collybia longipes (Bull.) Quél.
Collybia tuberosa (Bull.) Quél.
Corticium coeruleum (Schrad.) Fries
Fomes annosus (Fries) Cooke
Laetiporus speciosus (Batt.) Murrill
Panus stypticus (Bull.) Fries
Polyporus caudicinus (Scop.) Murrill
Porodaedalea Pini (Thore) Murrill
Xylaria Hypoxylon Pers.

To the above preliminary and very incomplete notes, may be added a few simple observations made on *Clitocybe illudens,* the most conspicuous of our luminescent species. The writer has frequently collected the beautiful orange hymenophores in New York, Virginia, North Carolina, and other states, and almost invariably they have been found to be luminous. On August 21, 1911, at 8 a. m., I collected about two bushels of the hymenophores of this species from an old oak stump in a low, shady woodland east of Bronx Park and brought them to my office in a large basket covered with fresh ferns. Several specimens, including wood containing the mycelium, were taken into the dark room at 8:30 a. m., but they exhibited no luminosity. At 10 a. m., a large cluster was first tried in the dark room, then exposed to diffused sunlight for an hour, and afterwards heated to 90° C. in 7 minutes in a drying oven, and at no time did it become luminous.

At 11 a. m., a cluster was immersed in cool water and left there 20 minutes, but this did not make it luminous. The water, now colored pale-orange, was tested in the dark room, but showed no luminosity. It was not to be expected that either the dissolved coloring matter or the mature spores held in suspension would possess photogenic properties.

At 1:30 p. m., the entire collection of hymenophores was taken from the herbarium to the dark room without removing them from the original basket, and no trace of light was observed during a period of 7 minutes. A piece of wood was then discovered in which the mycelium was evidently fresh and active, and this showed beautiful luminescence in a few seconds. On breaking this wood into pieces, the interior was even more luminous. Hymenophores were then broken apart and the mycelial cords at the base of the stipe exposed, with only negative results.

At 7:30 p. m., specimens taken from the herbarium to my home were tested in a dark closet in the presence of five people and in 1½ minutes the under surfaces of all the hymenophores were seen to glow conspicuously, while the upper surfaces remained dark. Water had no effect; dissolving out the coloring matter had no effect; and the colored liquid obtained was not luminous.

On August 22, at 8 a. m., I tried hymenophores of the same collection in the dark room at the Garden for 8½ minutes with entirely negative results, while wood containing the active mycelium was seen to glow distinctly within a minute or less. At 9 a. m., the specimens taken home the previous afternoon were examined in a dark closet and appeared luminous after 10 to 15 minutes. Pieces of wood containing the mycelium were found to glow promptly after lying in the herbarium all day.

At 9 p. m., the hymenophores at my home were again tested and luminosity was observed in 1 or 2 minutes. These specimens had been examined at 9 a. m. on the same day and during the evening of the previous day, lying meanwhile on a table in the living room.

On August 23, at 9:30 a. m., the wood containing mycelium, which had been lying on my desk in the herbarium, was found to be dry and no longer capable of luminescence. The observations were then discontinued.

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